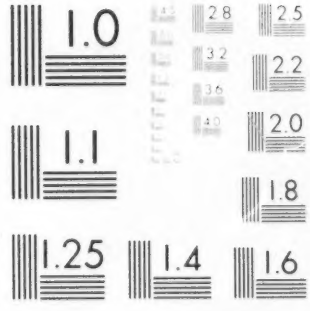

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ABSTRACT

This paper reports on a field test of a system for monitoring the achievement of selected educational governance/management goals. The study entailed (1) collection of enrollment, revenue, expenditure, and teacher assignment data from a stratified random sample of Minnesota districts for a seven-year period, 1969-70 through 1975-76; (2) reduction of data into indicators of demand, resource appropriation, resource allocation, and service capability; and (3) testing selected hypotheses to assess the sensitivity and effectiveness of the system or tentative model. The hypotheses tested were concerned with state-local share of school revenue, equalization of expenditures, and equal access to educational services. The stratification of the sample allowed consideration of the effects of enrollment size, wealth (property valuation per weighted pupil unit), level of expenditure, and enrollment trends on unit revenues, unit costs, and service capability. The importance of this research and development effort lies in its attempt to establish a system whereby the impact of state-level legislative and regulatory policies on public school districts can be monitored. The major conclusion of the study was that the proposed system indicated sufficient sensitivity to merit further development. (Author/IRT)

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MONITORING ACHIEVEMENT OF EDUCATIONAL GOVERNANCE/MANAGEMENT POLICY GOALS

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to
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Foreword

The authors wish to acknowledge the leadership role of the Minnesota State Planning Agency for stimulating, encouraging, and supporting this research and development effort. We also wish to acknowledge the excellent cooperation of the State Department of Education in data collection and their contribution to financial support of the project in the second stage. The authors assume full responsibility for the procedures, findings, and interpretations presented in this paper. In no way should this document be construed as representing an official position of the Minnesota State Planning Agency or the Minnesota Department of Education.

C.H.S.
V.L.H.

Monitoring Achievement of
Educational Governance/Management
Policy Goals

I. Introduction

The purpose of the research and development effort reported in this paper was to field test a system for monitoring the achievement of selected educational governance/management policy goals. The field test activities are reported in sections which present a) an introductory overview, b) study design, and c) results of the study. By way of introduction, this section deals with 1) background of the problem and 2) definition of the problem.

Background of the Problem

The Minnesota State Constitution mandates that the Legislature establish and maintain a uniform system of public schools. The Legislature has fulfilled this responsibility through statutes which established a State Board of Education and a State Department of Education, local districts with elected governing boards, taxing systems for the support of education, and an inter-governmental transfer system for distributing state-collected revenues. Collectively, these statutes and the administrative provisions attending their implementation constitute a state educational governance/management system for public elementary, secondary, and vocational schools.

Historically, the state educational governance/management system limited the powers of the State Board and the State Department of Education, but delegated a large measure of authority and accountability to local district boards of education. The statutes, expressing citizen interest

and preferences through participatory government, made local control of the educational governance/management system a reality. Once established, the educational governance/management system tended to lag behind changing social and economic circumstances that called for expanded educational services and more equitable access to those services. The need for legislative educational policy responses to social and economic change is generally present. The urgency for the responses varies with the rate and nature of the changes which occur. Significant changes in recent years include organization of public school bargaining groups, inflation of operating costs, shifting demographic patterns, adverse taxpayer reaction, demand for equal educational opportunity, and increased judicial intervention.

Legislative educational policy responses in Minnesota have included statutes which eliminated common (elementary) districts, provided a Public Employees Labor Relations Act (PELRA), and attempted major school finance reform (Omnibus Tax Bill of 1971 and subsequent amendments), to name three outstanding examples. The PELRA and its subsequent amendments provided for exclusive bargaining agents, state-level mediation of impasse, the right of administrators to organize and bargain collectively, and the right of public employees to strike under certain conditions.

The present field study focused on policy goals related primarily to fiscal matters. Therefore, the Omnibus Tax Bill of 1971 and its 1973 and 1975 Amendments constitute the major background elements in the present study. The primary policy issue surrounding the bill was property tax relief. At the same time, in the Minnesota case of Van Dusartz vs. Hatfield et al., a United States District Court judge denied a defendents' motion to dismiss a charge that the Minnesota school finance system violated the equal protection clause of the Fourteenth Amendment to the United States Constitution by making expenditures dependent on district wealth. The

Court retained jurisdiction of the case pending action by the Legislature. After a Governor's veto and a special legislative session, a new school finance program emerged. The new program included a basic foundation program and categorical aids for transportation and special education. The basic foundation program aid plan featured local levy limitations, prescribed limits on maintenance expenditures, allowed for high cost districts (grandfather levy), and recognized education overburden (AFDC aid). The statute also included special tax relief for farm lands (agricultural tax differential). An amendment in 1973 added a catch-up provision whereby low spending districts would be brought up to the state average in six years. A 1975 amendment permitted continuation of the excess levy for high expenditure districts. The passage of these amendments affected the implementation of the statute, but did not alter its basic philosophy. The question of constitutionality was not adjudicated because the plaintiffs in Van Dusartz vs. Hatfield et al., withdrew their petition after the initial legislation passed.[1] The state school finance system which emerged is complex and questions concerning the operation of several specific elements of the system are worthy of study. The broad overall policy goals or end results of the legislation are 1) the shifting of responsibility for the

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[1]For more detailed study of the statute and its school finance reform features see:

Betsy Levin and Thomas Muller, The Financing of Schools in Minnesota, Urban Institute, Washington, D.C., 1973.

Tim L. Mazzoni, Jr., State Policy Making for the Public Schools of Minnesota, Educational Governance Project, Ohio State University, Columbus, 1974.

John Ostrem and Douglas Smith, "The State Revenue Requirements of School Finance Reform" in School Finance Reform: A Legislator's Handbook. John Callahan and William Wilken, eds., National Conference of State Legislatures, Washington, D.C., 1976.

support of education from local to state-collected revenue, 2) the equalization of educational expenditures across the state, and 3) the equalization of access to educational services by students in all districts. The extent to which these three broad governance/management policy goals have been achieved is the subject of the present study.

Definition of the Problem

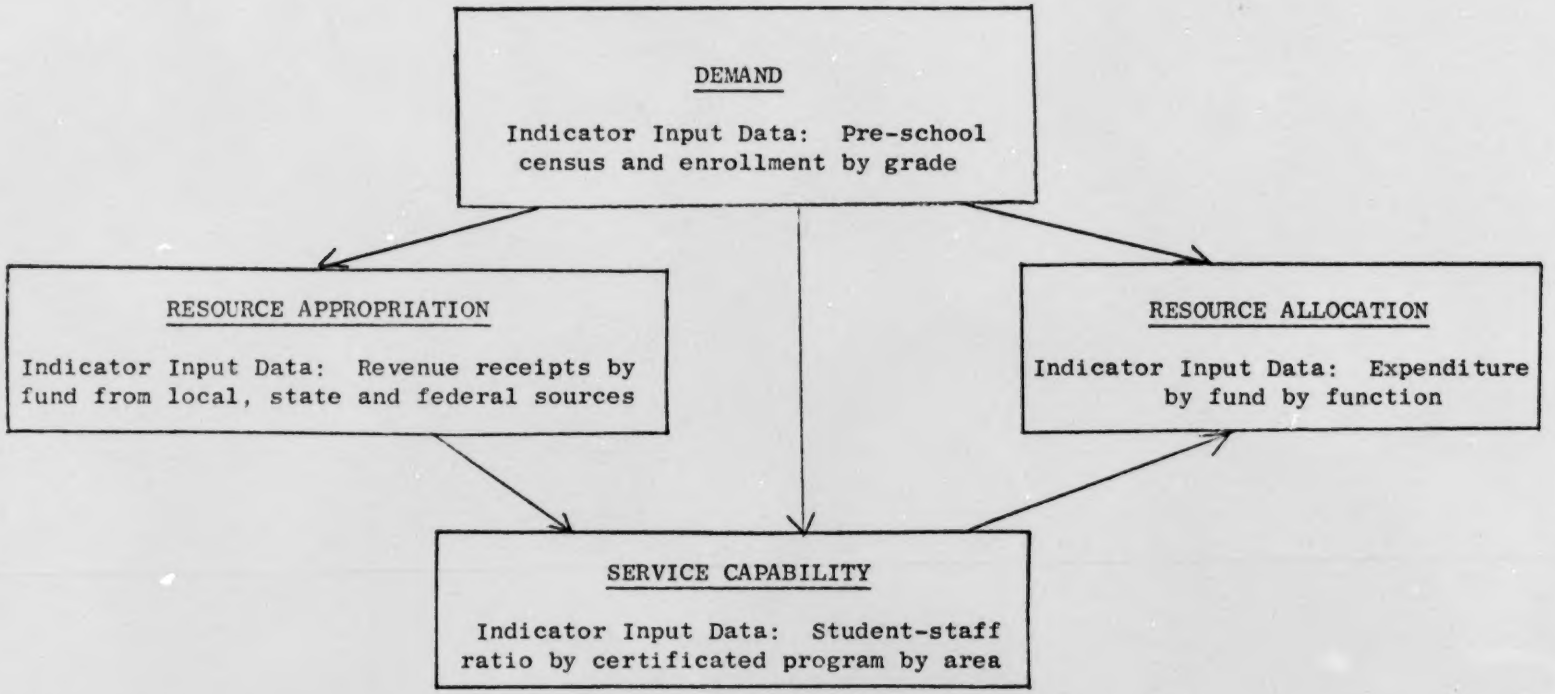
The legislative actions described above have clearly reversed the orientation of the state educational governance/management system from local control to stronger centralized state-level control. With the increased state-level control comes an increased need for timely information concerning the impact of policies and regulations on the performance of school districts. A particular policy or legislative enactment may produce programmatic or fiscal consequences which were not intended. Furthermore, changing social circumstances (such as declining enrollment) may require changes in the basic organizational structure for delivering educational services. The fundamental question is one of how, in the presence of complexity and diversity, can the condition and/or performance of local school districts be monitored so as to indicate the extent to which state-level governance/management policy goals are achieved.

Extensive data are regularly collected from local districts by sections and departments within the State Department of Education to perform regulatory functions. A monitoring system designed to reduce and utilize existing regulatory and reporting data was developed to provide indicators of trends in governance/management policy goal achievement. The system is presented graphically in the partial model presented in Figure I. The proposed monitoring system was based on the following assumptions:

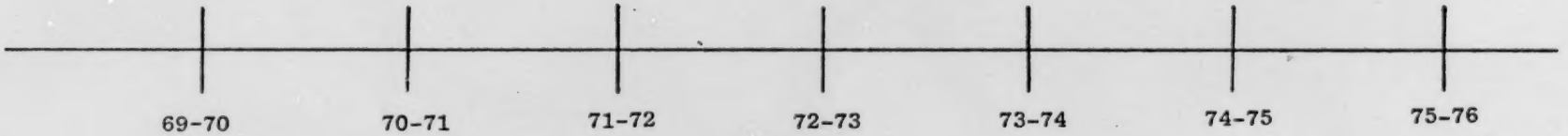
1. That because of compulsory attendance laws, school enrollment (actual or predicted) is the best general indicator of demand for educational services.

Figure I

PARTIAL MODEL SHOWING RELATIONSHIPS AMONG INDICATORS OF ACHIEVEMENT OF EDUCATIONAL GOVERNANCE/MANAGEMENT POLICY GOALS


DEMAND
Indicator Input Data: Pre-school census and enrollment by grade
RESOURCE APPROPRIATION
Indicator Input Data: Revenue receipts by fund from local, state and federal sources
RESOURCE ALLOCATION
Indicator Input Data: Expenditure by fund by function
SERVICE CAPABILITY
Indicator Input Data: Student-staff ratio by certificated program by area

Time line for proposed test of tentative model:



2. That revenue receipts from local, state, and federal sources by fund as reported in annual financial reports provides an adequate and uniform indication of fiscal resources available.

3. That expenditure by function by fund as reported in annual financial reports can be aggregated and divided by pupils enrolled or weighted pupil units to provide an accurate and uniform measure of unit costs.

4. That because education is a labor-intensive industry, the numerical staff-to-student ratio by programmatic area is the best general indicator of a district's capability to provide educational services.

5. That the selected indicators (demand, resources available, service capability, and unit costs) are adequate and appropriate in assessing policy goal achievement in spite of a lack of sensitivity to specific programmatic outcomes.

The field test of the proposed monitoring system was further defined by the following research questions:

1) To what extent has the proportion of locally collected revenue to the state revenue in the General and Transportation Funds (combined) changed during the period 1969-70 through 1975-76? Has this change been differentially related to enrollment size, wealth, level of expenditure, and enrollment trend variations in the local districts?

2) To what extent has the total expenditure per weighted pupil unit in average daily membership (ADM) from the General and Transportation Funds (combined) been equalized during the period 1969-70 through 1975-76? Are enrollment size, wealth, level of expenditure, and enrollment trends differentially related to the variance in unit expenditures?

3) Has the relationship between total expenditures per pupil unit from General and Transportation Funds (combined) and total service capability among all districts changed during the period 1969-70 through 1975-76? Have similar changes taken place for regular classroom instruction, special education, instructional support services, and line administration? Have the changes noted above been differentially related to enrollment size, wealth, level of expenditure and enrollment trend variations in the local districts?

The ability to answer these questions provided the criteria by which the effectiveness and utility of the proposed monitor system was evaluated in the field test.

II. Design of the Study

The design of the study is summarized in the following sub-sections dealing with a) population and sampling, b) sources of data, and c) treatment of data.

Population and Sampling

The population in the study consisted of all Minnesota independent school districts in operation during the years 1969-70 through 1975-76 inclusive. The sampling frame was prepared using the official Minnesota Educational Directory for 1969-70. Those districts which were not listed in the official Minnesota Educational Directory for 1975-76 or for which stratification data were not available were dropped from the frame. The sampling frame contained 426 districts.

A summary of selected characteristics of the population districts included in the sampling frame is presented in Table 1.

Table 1
Characteristics of Minnesota School Districts
Included in Monitor System Study Sampling Frame, N = 426

Characteristic	Range		Mean	Standard Deviation
	High	Low		
Enrollment size[a]	73,001	78	2,270.1	5,532.1
Wealth[b]	$22,873	$450	$8,929.54	$3,978.71
Expenditure level[c]	$ 1,055	$340	$ 654.71	$ 93.96
Enrollment trend[d]	+48%	-37%	-1.57%	11.59%

a. Enrollment size stated in terms of resident weighted pupil units in average daily attendance (ADA) during 1969-70. Pupil unit weighting as follows: K = .5, grades 1-6 = 1., and grades 7-12 = 1.5.

b. Wealth measured in terms of 1967 adjusted assessed valuation or Equalization Aid Review Committee (EARC) valuation per weighted pupil unit in ADA. The 1967 EARC was the basis for equalizing local support in 1969-70.

c. Expenditure level is the adjusted maintenance cost per weighted pupil unit in ADA for 1970-71 as reported in State Department of Education, Accounting Memo No. 1. The 1970-71 data were used because they were the basis for classifying districts as "high" or "low" expenditure under the Omnibus Tax Law of 1971.

d. Enrollment trend is the percent of change in total district enrollment between 1970-71 and 1974-75 as reported in Office of the State Demographer, Minnesota State Planning Agency Analysis of Public School Enrollment 1970-1974, (St. Paul, 1975).

The data in Table 1 indicate wide variations in characteristics of Minnesota school districts. Population districts ranged in enrollment size from 73,001 to 78 resident weighted pupil units in average daily attendance in 1969-70, the first year of the field test study period. In that same year, district wealth per pupil unit ranged from $22,873 to $450. The lowest figures in the range are accounted for by districts with considerable amounts of tax exempt property. The adjusted maintenance expenditure per pupil unit in ADA for 1970-71, the base year for school finance reform in the Omnibus Tax Law of 1971, ranged from $1,055 to $340. Enrollment trends for the period 1970-71 through 1974-75 ranged from a growth of 47 per cent to a decline of 37 per cent. Using the same data for all 436 districts in the state, the Advisory Council on Fluctuating School Enrollments reported that 21 per cent of the districts experienced enrollment growth $\geq$ 6 per cent, 38 per cent of the districts were stable with changes of $\pm$ 5 per cent or less, and 41 per cent of the districts declined 6 per cent or more.[2]

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[2]Advisory Council on Fluctuating School Enrollments, Van D. Mueller, Chairperson. The Impact of Fluctuating School Enrollments on Minnesota's Educational System, Vol. I (St. Paul, 1977), p. 6.

To insure that the sample was representative of the diverse population, the districts were stratified on the basis of enrollment size, wealth, expenditure level, and enrollment trends. Districts were categorized as "large" if they served 1,317 (33rd percentile) or more resident weighted pupil units in ADA during 1969-70 and "small" if they served fewer. Districts were categorized as "high valuation" districts if their 1967 EARC valuation per pupil unit in ADA was $8,340 (the median) or more during 1969-70. Districts with taxable wealth below the median were categorized as "low valuation" districts. "High expenditure" districts were those that spent $663 or more in adjusted maintenance cost per pupil unit in 1970-71. Districts spending less than $663 were categorized as "low expenditure". The $663 dollar per pupil unit in average daily membership (ADM) represents an estimated average adjusted maintenance cost for 1970-71 fixed by the legislature for use in calculation of foundation aid payments. Districts were categorized into three enrollment trend groups; 1) "growing" districts had enrollments which increased 6 per cent or more, 2) "stable" districts had enrollments which did not fluctuate more than $\pm$ 5 per cent and 3) "declining" districts had enrollment decreases of 6 per cent or more during the period 1970-71 through 1974-75. A computer program was utilized to place districts into 24 cells on the bases of these stratification characteristics.

A ten per cent sample was drawn at random from each cell, subject to replacement if it did not meet the following conditions:

1) The district must have served grades K-12 throughout the study period. While most Minnesota districts offered kindergarten, it was not compulsory until after July 1, 1974.

2) The district did not operate a post-high school area vocational technical institute (AVTI). AVTI revenues and expenditures were not carried in a separate fund until 1971-72. To include districts with AVTI's would cause a mixing of elementary and secondary with post-high school data.

3) The district could not have been involved in reorganization or consolidation actions which increased its enrollment 5 per cent or more over any preceding year.

Using these sampling procedures to insure uniformity of data throughout the study period, a 45 district statified random sample was drawn. Sampling procedures imposed two major limitations on the study in that no cities of the first class were included and that the sample is representative of school district organizations, but not representative of school districts in terms of where most students attend school.

Sources of Data

All data were collected from official files of the Minnesota State Department of Education. Indicator input data collected related to demand, resource allocation (revenue), resource appropriation (expenditure), and service capability components of the system.

Input data for the demand component consisted of fall enrollment by grade by district by year (Form F23-5) and preschool census by age by district by year (Form F29-3d). Weighted pupil units can be readily derived from enrollment data. However, official total weighted pupil unit data were available and were utilized (Form F29-6 Section E).

The input data for resource allocation consisted of revenue receip by source (local, state, and federal) by fund by district by year. The phrase resource appropriation was used to describe the application or use (expenditure) of resources available. Input data for this component consisted of expenditures by function by fund by district by year. Both revenue and expenditure data were collected from school district Annual

Financial Reports (Form F29-2a) submitted to the State Department of Education. Format and content of the Annual Financial Report varied slightly from year to year. As a result, a data collection form that would accomodate variations across the seven-year study period was prepared. Written instructions for data collection were prepared to insure uniformity of application.

The service capability component represents an interaction of enrollment and staffing data. The staffing data originated on the SDE Elementary, Secondary, and Post Secondary School Personnel Record (Form F30-23) which is prepared for each staff member (excluding clerical, custodial, drivers aids, etc.) employed in a local district each year. The initial and primary use of data collected by the SDE on this form was to insure that professional staff held appropriate certificates for their assignments. The data elements collected for this study included a 6-digit assignment code indicating subject-matter teaching area, a 2-digit grade level code, and a 2-digit periods-per-week code in addition to basic teacher file and district identification data. For the years 1969-70 through 1972-73 the data were collected by key punching directly from State Department of Education printouts. Data for the years 1973-74 through 1975-76 were transferred from magnetic tapes stored at the Minnesota Analysis and Planning System (MAPS). All enrollment, fiscal, and personnel data were stored on a magnetic tape.[3]

Another element of data added to the tape was the consumer Price Index. Using 1967 as the base year, monthly consumer price indices for all items were averaged to yield indices that corresponded to the each of the school fiscal years in the study period.

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[3]Bureau of Field Studies and Surveys, Sample School District Data Base Development Tape a report prepared for the Minnesota State Planning Agency. (St. Paul, 1976).

Treatment of Data

Special programs were written to transform input data for use in analysis. The special programs dealing with resource appropriation (revenue) and resource allocation (expenditures) were similar in that both were designed for easy aggregation of multi-dimensional inputs.

In the case of revenue data, inputs were recorded on an 18 row (source) by 4 column (fund) matrix for each district for each year. For purposes of the analyses reported in the present paper, input data were aggregated by source level; local, state, federal and total (Σ of local, state, federal, and incoming transfer accounts). The statistic used in responding to the first research question was local revenue as a percent of state revenue. The aggregates of revenue receipts in the General and Transportation Funds from local sources were combined and divided by the a simalar total from state level sources and multiplied by 100.

The resource allocation (expenditure) input data were recorded on a 63 row (function-object) by 4 column (fund) matrix. These were aggregated by function (100 Series-Administration, 200 Series-Instruction, 300-400 Series-Attendance and Health Services, 500 Series-Transportation, 600 Series-Operation of Plant, 700 Series-Maintenance of Plant, 800 Series-Fixed Charges, 1400 Series-Outgoing Transfer Accounts, and Total) for the General and Transportation Funds (combined). For the analyses reported in the present paper the expenditures aggregated in each category were adjusted using the Consumer Price Index with 1967 as the base year. Adjusting the category totals using the CPI served to keep the value of the dollar units constant over the study period. The test statistic used in responding to the second research question was the adjusted average expenditure per pupil unit in ADM in each district by year. This statistic was derived by

dividing the adjusted combined totals of the General and Transportation Funds by the number of weighted pupil units in ADM in each district each year.

The most complex of the special programs produced the statistic, service capability, used in responding to research question three. This statistic was developed in three stages. In the first stage, all legitimate assignment codes were aggregated into the categories of the following taxonomy for each district for each year:

Total Reported Staff _____

I. Line Administration _____
   - A. General (Superintendency) _____
   - B. Elementary (Principalship) _____
   - C. Secondary (Principalship) _____

II. Certified Executive Staff _____
   - A. General (Coord. Dir., etc.) _____
   - B. Elementary (Coord. Dir., etc.) _____
   - C. Secondary (Coord. Dir., etc.) _____

III. Non-Certificated Executive Staff _____
   - A. General (Managers, etc.) _____
   - B. Elementary (Managers, etc.) _____
   - C. Secondary (Managers, etc.) _____

IV. Regular Elementary Instruction _____
   - A. Early Elementary _____
   - B. Grades 1-6 _____
   - C. Art _____
   - D. Remedial Reading _____
   - E. Foreign Language _____
   - F. Physical Education _____
   - G. Home Economics _____
   - H. Industrial Arts _____
   - I. General Music _____
   - J. Instrumental Music _____
   - K. Other _____

V. Regular Secondary Instruction _____
   - A. Agriculture _____
   - B. Art _____
   - C. Distributive Education _____
   - D. English Language Arts _____
   - E. Foreign Language _____
   - F. Health Occupations _____
   - G. Health, Physical Education, and Safety _____
   - H. Home Economics _____
   - I. Industrial Arts _____

J. Mathematics ____
K. Music ____
L. Natural Science ____
M. Office and Business Education ____
N. Social Science ____
O. Trade and Instustrial ____
P. Other ____

VI. Elementary Special Education ____
A. Mentally Retarded ____
B. Speech Therapy ____
C. Special Learning Disabilities ____
D. Physically Handicapped ____

VII. Secondary Special Education ____
A. Mentally Retarded ____
B. Speech Therapy ____
C. Special Learning Disabilities ____
D. Physically Handicapped ____

VIII. Pupil Personnel (Counselors, Psychologists, etc.) ____
A. General (district wide) ____
B. Elementary ____
C. Secondary ____

IX. Library, Media, Reading ____
A. General ____
B. Elementary ____
C. Secondary ____

In the second stage of the special personnel program the numbers of personnel in each of the taxonomatic categories were converted to full time equivalents (FTE). The conversion was effected by a series of decision rules in which the number of periods per week were divided by different standard values of 25 and 30 or computed proportional values depending on the configuration of personnel assignment codes. The third stage involved aggregating enrollments associated with personnel assignments (elementary, secondary, and total) for each district by year and computing the number of FTE staff per 1000 students. For purposes of the analyses presented in this paper, FTE personnel assignments were aggregated into the following categories:

1) Total FTE Staff (Σ I. through IX.)
2) Elementary and Secondary Staff (Σ IV. and V.)

3) Elementary and Secondary Special Education (≤ VI. and VII.)
4) Instructional Support Staff (≤ II., III., VIII., and IX.)
5) Line Administration (I.)

The statistic employed in dealing with the third research question was derived using this program and consisted of categorical FTE staff per 1,000 students.

A four-way multivariate analysis of variance was employed to examine Question 1 and its sub-questions, which consisted of selected interactions. The four design variables were the four sampling stratification categories--size, wealth, expenditure, and enrollment trends. These design variables generated a 2 x 2 x 2 x 3 framework (24 cells) with the usual "main effects" and interactions. The computer program used (UMST 570, University Computer Center, University of Minnesota) generates a "grand mean" test. The seven "response variables" consisted of the revenue percentages (local revenue as a percent of state revenue) for each of the seven years. However, these were transformed into six linearly independent variables, according to the matrix presented in Figure II.

FIGURE II

Linear Transformation Matrix Applied to Local/State Revenue Percent for Seven Years

Transformations	69-70	70-71	71-72	72-73	73-74	74-75	75-76
1	-1	1/6	1/6	1/6	1/6	1/6	1/6
2	0	-1	1/5	1/5	1/5	1/5	1/5
3	0	0	-1	1/4	1/4	1/4	1/4
4	0	0	0	-1	1/3	1/3	1/3
5	0	0	0	0	-1	1/2	1/2
6	0	0	0	0	0	-1	1

A multivariate analysis of variance was then performed on these six linearly independent combinations using the four design variables. In this type of analysis the "grand mean" test then examines the differences among the seven response variables. This corresponds to the first main question which asks "Are there changes among the seven years on the revenue percentage variable?" This test was identified in Table 3 in the Results of the Study section as the "year" test. The main effects of the analysis are then interpreted as interactions with the six response variables. These correspond to the four sub-questions under Question 1 and are identified in Table 3 as year by size, year by wealth, year by expenditure, and year by enrollment trend. In Table 3 higher order interactions are also reported, although they are not of primary interst.[4]

The extent to which expenditures per weighted pupil unit had been equalized in districts across the seven-year time period studies was measured in terms of the standard deviation. As expenditures become more equalized the standard deviation for the districts should decrease. Therefore, Table 4 in the Results of the Study section presents the standard deviation for each of the seven years for all districts, and for sub-sets of districts broken down by size, wealth, expenditure level, and enrollment trend. However, a completely legitimate statistical test procedure for Question 2 is not available. The usual test for the difference between two variances based on independent samples (such as the variances for a given year for large and small districts), or the Bartlett test for differences among several independent variances (such as variances for a given year for the decreasing, stable, and increasing enrollment districts) are available, but do not address themselves to whether the variances (standard

[4]R. Darrel Bock, Multivariate Statistical Methods in Behavioral Research, New York: McGraw-Hill, 1975.

deviations) change across the seven year period. There exists a test for difference between two correlated variances but this has not been extended to three or more correlated variances.[5] Therefore, the results in Table 4 must be related primarily to the question by inspection. However, the correlated variance test was applied to the first and seventh year variances for the total districts and for each breakdown indicated in Table 4. The formula was as follows:

$$t = \frac{(S_A^2 - S_B^2)\sqrt{N-2}}{\sqrt{4S_A^2 S_B^2 (1-r_{AB}^2)}}$$

This t-ratio is interpreted with N-2 degrees of freedom. The test for differences between or among independent variances were applied for each year across the sampling breakdowns as indicated in Table 4.

Question 3 considers the relationship between total expenditures per pupil unit and various measures of service capability. In addition, it asks whether this relatonship has changed across the seven year time period being studied, and also whether the relationship has been the same for districts categorized as large or small, low or high valuation, low or high expenditure, and decreasing, stable, or increasing enrollment. To examine these questions general linear models were developed using statistical techniques and a computer program described by Ward and Jennings.[6] To examine the main part of Question 3, Model 1 as indicated below was developed.

Model 1

$$Y = a_1X^{(1)}+b_1V^{(1)}+a_2X^{(2)}+b_2V^{(2)}+---+a_7X^{(7)}+b_7V^{(7)}+d_1W^{(1)}+d_2W^{(2)}+---+d_{45}W^{(45)}$$

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[5]Quinn McNemar, Psychological Statistics, 3rd Ed., New York: John Wiley and Sons, Inc., 1962, pp. 246-250.

[6]Joe Ward and Earl Jennings, Introduction to Linear Models, Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1973.

Vector Y was the criterion variable (a service capability variable). Vectors X(1) through X(7) contained one if the corresponding criterion value was obtained from the first through seventh years, 0 otherwise. Vectors V(1) through V(7) contained the expenditure per pupil in ADM values for a service capability value from years one through seven, 0 otherwise. Vectors W(1) through W(45) contained ones to indicate whether the service capability value was from districts 1 through 45, 0 otherwise. Vectors W were required in order to account for the interdependence on the seven measures of expenditures and service capabilities. It should be realized at this point that the vectors are seven times 45 or 315 elements in length. Each pair of vectors such as X(1) and V(1) thus define a least squares line relating expenditure to service capability for a given year. The coefficient for the V vectors indicates the slope of the lines for each year. To examine whether these are equal it was hypothesised that the b coefficients were the same for each year. This results in a model where the V vectors are replaced by their sum. The X vectors and W vectors are retained in this restricted model. The multiple R^2 resulting from these two models was then compared to test the hypothesis that relationships are the same across the seven years. This analysis was conducted separately for each of the five service capability variables.

To examine the sub-questions under Question 3 it was necessary to treat each explanatory variable (size, expenditure level, wealth, and enrollment trend) separately, since it was not possible to get all the necessary vectors into the computer to permit a more complex analysis. To examine the sub-question pertaining to enrollment size, for example, another model such as the following Model 2 was developed by "splitting" each of the X and V vectors into two additional vectors which reflect small and large districts.

Model 2

$$Y = a_{1.S}X^{(1.S)} + b_{1.S}V^{(1.S)} + a_{1.L}X^{(1.L)} + b_{1.L}V^{(1.L)} + a_{2.S}X^{(2.S)} + b_{2.S}V^{(2.S)} + \cdots$$

$$+ a_{7.L}X^{(7.L)} + b_{7.L}V^{(7.L)} + d_1W^{(1)} + \cdots + d_{45}W^{(45)}$$

The hypothesis that the relationship between expenditure and the service capability variable was the same for small and large districts for a given year was then tested by comparing this model to Model 1. Again, the analysis was conducted separately for each service capability variable. The structure of the second model was the same when the sub-questions pertaining to wealth and expenditure level were examined, when the X and V vectors were split according to the relevant categories. An analogous model was constructed for examining the sub-question pertaining to enrollment trend. It is not presented here, but the X and V vectors were split into three vectors each rather than two.

III. Results of the Study

The results of the study are reported in sections dealing with 1) realtionship of state and local revenues, 2) equalization of expenditures, 3) service capability, 4) summary of results, 5) conclusions, and 6) implications for further study.

State and Local Revenues

The first research question was concerned with the extent that the proportion of locally-collected revenue to state-collected revenue in the General and Transportation Funds (combined) changed during the period 1969-70 through 1975-76. The question was further concerned whether any change was related to the stratification variables of enrollment size, wealth, level of expenditure, and enrollment trends. The data in Table 2

TABLE 2

Mean Per Cent Local of State Revenue[a]
for Sample Stratification Cells,
Low and High Expenditure Districts,
and All Districts by Year

Cell[b]	N	Mean Per Cent						
		1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76
1111	2	37.1	31.0	21.2	12.7	11.8	15.8	14.0
1112	5	75.9	55.1	48.2	28.6	27.0	27.6	27.4
1113	3	67.8	60.9	49.9	29.3	34.8	26.2	17.2
1121	1	54.6	67.0	45.9	43.3	35.6	42.1	15.8
1122	1	82.0	70.9	45.9	30.8	33.2	33.3	28.1
1123	1	66.9	81.2	53.5	35.6	51.6	27.3	30.0
1211	5	125.0	107.3	71.4	53.0	65.0	53.7	46.0
1212	3	91.4	89.6	62.3	50.0	55.7	42.4	39.5
1213	1	159.3	138.0	102.2	82.6	68.9	49.6	88.8
1221	3	133.8	118.8	129.8	82.5	78.9	70.6	71.3
1222	2	167.1	125.6	133.5	73.6	73.5	55.3	36.5
1223	1	60.4	79.4	69.2	37.5	40.8	25.4	24.9
2111	1	29.3	109.6	39.5	29.4	24.6	30.1	29.0
2112	2	37.9	24.2	23.2	17.7	22.7	20.2	18.7
2113	3	59.0	58.3	42.9	34.5	30.5	20.3	25.4
2121	1	150.4	55.4	44.5	13.7	37.7	12.8	22.9
2122	1	107.2	114.0	82.5	51.8	50.6	63.3	26.0
2123	1	93.2	118.9	114.6	73.8	68.3	66.0	67.0
2211	1	74.0	67.7	54.4	38.0	38.2	32.6	40.1
2212	1	70.6	67.5	82.0	33.1	58.9	30.2	27.7
2213	1	65.5	76.4	52.8	32.2	31.2	31.4	21.0
2221	2	139.2	170.4	173.8	134.9	120.6	140.2	130.4
2222	2	104.8	104.9	104.3	66.6	67.1	74.1	72.6
2223	1	154.2	123.9	74.1	45.2	40.5	46.2	56.7
Low Exp.	28	78.8	71.7	53.0	36.6	39.8	32.8	31.6
High Exp.	17	117.2	109.9	102.5	66.4	65.7	62.8	56.7
All Dist.	45	93.3	86.1	71.9	47.9	49.6	44.1	41.1

a. $\frac{\text{Local}}{\text{State}} \times 100$

b. Cell Code
First digit: 1 = small, 2 = large
Second digit: 1 = low valuation, 2 = high valuation
Third digit: 1 = low expenditure, 2 = high expenditure
Fouth Digit: 1 = declining, 2 = stable, 3 = increasing

present the mean per cent local revenue is of state revenue in each of the sample cells, high and low expenditure districts, and all districts by year.

Setting the probability for a type one error at .05, the year test in Table 3 is significant. It can be said with a high degree of confidence that the percent local to state revenue has changed across the seven year period. Examination of the "all district" means in Table 2 shows that a gradual decline occurred during the first three years, followed by a sharp drop in the 1972-73 year, followed by a still lesser decline in the last two years. Only one of the subsidiary questions, indicated by the year by expenditure test in Table 3, yielded significant results. The changes across the seven-year period are apparently not the same for low and high expenditure districts. Examiniation of the means for low and high expenditure districts in Table 2 indicates that the low expenditure districts experienced a rather gradual decrease from 1969-70 down to 1972-73 followed by a leveling-off period. The high expenditure districts exhibited a lesser decrease from 1969-1970 to 1971-72 followed by a rather drastic decrease between 1971-72 and 1972-73.

Two of the higher order interactions in Table 3 also yielded statistically significant results. These four and five way interactions are difficult to interpret, but examination of the means for each of the 24 cells in Table 2 indicates that the basic decline in percent of local to state and the differential between low and high expenditure districts is maintained, with a few exceptions. The single small, high valuation, low expenditure, increasing enrollment district (1213) experienced a rather drastic increase in the 1975-1976 school year. The large, low valuation, low expenditure, decreasing enrollment district (2111) exhibits a rather

TABLE 3

Multivariate Analysis of Variance Summary
for Percent Local of State Revenue

Test	F Ratio	Degrees of Freedom	Probability
Year	46.08	6/16	.000*
Year x Enrollment (N)	.80	12/32	.647
Year x Expenditure (X)	6.47	6/16	.001*
Year x N x X	1.54	12/32	.160
Year x Wealth (W)	2.25	6/16	.092
Year x W x N	.57	12/32	.853
Year x W x X	1.68	6/16	.191
Year x W x N x X	1.13	12/32	.370
Year x Size (S)	1.42	6/16	.267
Year x S x N	.57	12/32	.848
Year x S x N	1.02	6/16	.447
Year x S x N x X	.74	12/32	.705
Year x S x W	.74	6/16	.628
Year x S x W x N	1.81	12/32	.088
Year x S x W x X	2.96	6/16	.039*
Year x S x W x X x N	2.26	12/32	.033*

*Significant at .05 level

level percentage across the seven years except for a sizeable increase in the 1970-1971 year. The large, low valuation, high expenditure, increasing enrollment district (2123) and the large, high valuation, high expenditure, decreasing enrollment districts (2221) indicate a rise in percent local to state revenue during the second and third years, followed by the general decline during the last four years. The large, low valuation, high expenditure, decreasing enrollment district (2121) exhibits an abnormally high percentage during the 1969-1970 year followed by the typical pattern during the last six years.

Although these higher level interactions are significant, the relatively small sample size of 45 districts does not permit the researchers to make any particular generalizations from them. Rather, they are mentioned only as exceptions of one or two districts to the general pattern of decreasing local to state percentage and differential decreases between low and high expenditure districts. It is possible that cash accounting procedures could account for some of these variations.

Equalization of Expenditures

When the variances for 1969-1970 and 1975-1976 years were tested for statistically significant differences using the t-ratio presented earlier, the results were not significant either for the total group of 45 districts or for the various sub-groups broken down by size, valuation, expenditure, and enrollment trend. As mentioned earlier this is not a completely appropriate technique since it ignores the possibility of detecting any patterns evidenced by the intervening years. Inspection of the standard deviations in Table 4, however, indicates that there might be the possibility of a general decrease in standard deviation, which could be interpreted

TABLE 4

Standard Deviations for Expenditures per ADM
(Adjusted for CPI)

		N	69-70	70-71	71-72	72-73	73-74	74-75	75-76
Size	<1317	28	89.7	97.6	85.6	92.0	81.5	83.0	101.6
	≥1317	17	118.8	96.7	105.5	92.0	101.8	90.2	94.4
Wealth	<8340	22	73.3	85.4	73.4	88.8	81.7	83.9	101.7
	≥8340	23	114.5*	99.4	101.7	87.9	91.6	84.4	91.6
Expenditure	< 663	28	66.6	36.2	46.8	59.4	47.1	56.5	63.6
	≥ 663	17	103.2*	74.0*	81.5*	72.7	85.9*	74.3	96.0
Enrollment Trend									
	≤6%	16	102.6	109.2	101.5	86.9	99.6	90.1	99.9
	-6%<x<+6%	17	94.1	93.4	97.1	97.3	88.1	71.5	84.0
	≥6%	12	112.1	84.3	74.9	93.7	76.8	82.3	110.5
All Districts		45	100.4	96.6	92.5	91.1	88.6	85.5	98.2

*Independent variances statistically different at .05 significance level.

as greater equalization of expenditures, but there are easily observed fluctuations in some of the sample sub-groups and a general increase in the 1975-1976 school year. Therefore, there appears to be no evidence that greater equalization of expenditures per pupil unit in ADM has occurred over the seven-year time period being studied.

In order to examine the sub-questions for Question 2, analyses were conducted to see if the variances between sample stratification categories were significantly different for a given year. The difference between low valuation and high valuation districts for 1969-1970 was statistically significant, whereas the differences are not significant for the remaining six years. This would indicate that a high degree of difference in variability between low valuation and high valuation districts has decreased.

The differences between low and high expenditure districts were statistically significant for 1969-1970, 1970-1971, 1971-1972, and 1973-1974. Examining the pattern of standard deviations, it appears that high expenditure districts consistantly exhibit greater variability in expenditures per pupil unit ADM than low expenditure districts.

Service Capability

Table 5 presents the relevant statistics pertaining to research Question 3. The table values for each year and service capability variable are the coefficients of the V vectors for the models discussed earlier. They can be interpreted as the mean linear relationship between CPI adjusted expenditure per pupil unit in ADM in increments of $10.00 and FTE per thousand service capability. For example, in the year 1969-1970 for the total service capability this relationship indicated that on the average for each $10.00 increase in expenditure per pupil unit in ADM an expected mean increase of .455 FTE's per 1,000 students was found in the sample of 45 districts.

TABLE 5

Relationship Between Expenditures $10/ADM (adjusted for CPI)
and Service Capability -- All Districts

Service Capability	Year							All Years	R^2 Full	R^2 Rest	F*	P
	69-70	70-71	71-72	72-73	73-74	74-75	75-76					
Total	.455	.421	.358	.351	.374	.371	.323	.402	.286	.285	.06	1.00
Regular Instruction	.346	.331	.275	.255	.264	.261	.328	.306	.259	.258	.06	1.00
Special Ed. Instruction	+.001	-.003	-.002	-.000	-.014	-.001	+.023	-.002	.255	.248	.39	.88
Support	.074	.012	.012	.011	.008	.010	.018	.029	.190	.181	.45	.84
Line	.059	.063	.057	.054	.065	.059	.054	.066	.232	.231	.05	1.00

*Degrees of freedom are 6 and 256.

The third major question examined the possibility of a change in relationship between expenditures per pupil unit in ADM (adjusted for CPI) and each of the five aggregate measures of service capability over the seven-year period being studied. Examination of the results presented in Table 5 indicates that there is no evidence that the relationships have changed. For each of the service capabilities the relationship remains fairly steady across the seven years. The strength of the relationship varies depending upon the service capability. For example, the relationship is much stronger for regular instruction, line administration, and total service capability than it is for special education instruction and support personnel. These questions, however, were not dealt with at this time.

The sub-questions for research Question 3 examined the extent to which the relationships differed for districts categorized by size, wealth, expenditure level, and enrollment trend. Table 6 presents the results for districts categorized by size. Examination of these statistics indicates that differential effects are found for line administration, regular instruction, and total service capability and that there is a much stronger relationship between expenditures and service capability for small districts than for large. However, for each classification of district, the relationship remains fairly stable across the seven-year perid.

Examination of the results summarized in Tables 7, 8 and 9 indicates that no significant results were obtained when districts were examined separately by wealth, expenditure level or enrollment trend.

TABLE 6

Relationship Between Expenditures $10/ADM (adjusted for CPI) and Service Capability -- Districts Categorized by Size

Service Capability	Size	Year 69-70	70-71	71-72	72-73	73-74	74-75	75-76	R^2 Full	R^2 Rest	F*	P
Total	Sm	.663	.668	.346	.367	.435	.446	.316	.508	.472	2.53	.02
	Lg	.262	.275	.247	.245	.242	.219	.256				
Regular Instruction	Sm	.571	.524	.332	.311	.306	.314	.224	.476	.438	2.50	.02
	Lg	.178	.229	.205	.197	.188	.082	.187				
Special Ed. Instruction	Sm	.003	-.005	.000	.000	-.003	-.002	.015	.269	.267	.11	1.00
	Lg	-.000	-.004	-.010	-.018	-.003	.016	.021				
Support	Sm	.008	.006	.004	.011	.010	.009	.010	.270	.262	.38	.91
	Lg	.081	.012	.012	.010	.014	.013	.016				
Line	Sm	.091	.070	.055	.054	.074	.066	.052	.525	.487	2.72	.01
	Lg	.026	.024	.020	.020	.020	.023	.025				

*Degree of freedom are 7 and 242.

TABLE 7

Relationship Between Expenditures $10/ADM (adjusted for CPI) and Service Capability -- Districts Categorized by Wealth

Service Capability	Wealth	Year							R^2 Full	R^2 Rest	F*	P
		69-70	70-71	71-72	72-73	73-74	74-75	75-76				
Total	Poor	.210	.157	.477	.177	.211	.194	.164	.323	.320	.13	1.00
	Rich	.360	.430	.224	.222	.231	.261	.185				
Regular Instruction	Poor	.123	.111	.232	.086	.100	.087	.201	.312	.310	.12	1.0
	Rich	.230	.276	.143	.134	.145	.147	.088				
Special Ed. Instruction	Poor	.003	.007	.016	.038	.024	.024	.032	.347	.332	.80	.58
	Rich	.005	-.001	-.005	-.015	.000	.001	.016				
Support	Poor	.007	.004	.000	.003	.001	.004	.006	.195	.191	.17	.99
	Rich	.093	.015	.019	.003	.003	.005	.013				
Line	Poor	.020	.016	.019	-.011	.017	.020	.017	.239	.238	.05	1.00
	Rich	.037	.029	.025	.028	.033	.027	.025				

*Degress of freedom are 7 and 242.

TABLE 8

Relationship Between Expenditures $10/ADM (adjusted for CPI)
and Service Capability -- Districts Categorized by Expenditure Level

Service Capability	Expenditure Level	Year 69-70	70-71	71-72	72-73	73-74	74-75	75-76	R^2 Full	R^2 Rest	F*	P
Total	Lo	.237	.066	1.334	.079	.076	.060	.059	.260	.259	.04	1.00
	Hi	.108	.099	.052	.048	.087	.065	.049				
Regular Instruction	Lo	.111	.086	.204	.138	.134	.084	.186	.236	.231	.22	.98
	Hi	.171	.186	.106	.097	.120	.097	.065				
Special Ed. Instruction	Lo	-.017	-.004	.000	-.002	-.020	-.001	-.001	.268	.263	.22	.98
	Hi	.006	-.004	-.014	-.002	-.004	.000	.021				
Support	Lo	.029	.004	-.013	.005	.003	.002	-.004	.192	.191	.04	1.00
	Hi	.035	.003	.001	.001	.001	.006	.010				
Line	Lo	.031	.025	.023	.028	.028	.028	.023	.216	.215	.04	1.00
	Hi	.033	-.002	.027	.021	.035	.028	.027				

*Degrees of freedom are 7 and 242.

TABLE 9

Relationship Between Expenditures $10/ADM (adjusted for CPI)
and Service Capability -- Districts Categorized by Enrollment Trend

Service Capability	Enrollment Trend	Year 69-70	70-71	71-72	72-73	73-74	74-75	75-76	R^2 Full	R^2 Rest	F*	P
Total	Dec.	.298	.319	.245	.222	.248	.333	.175	.400	.390	.29	.99
	Stab.	.288	.266	.335	.144	.161	.137	.114				
	Inc.	.121	.091	.319	.112	.122	.129	.114				
Regular Instruction	Dec.	.224	.229	.195	.147	.150	.188	.087	.366	.362	.09	1.00
	Stab.	.176	.169	.206	.084	.099	.065	.090				
	Inc.	.075	.097	.252	.068	.058	.041	.215				
Special Ed. Instruction	Dec.	-.011	.000	-.002	.000	.012	-.002	.020	.280	.272	.19	1.00
	Stab.	.002	-.005	.000	-.001	-.018	.000	.016				
	Inc.	.002	-.001	.000	.009	-.009	.018	.023				
Support	Dec.	.160	.007	.002	.001	.002	.000	.008	.241	.209	.67	.80
	Stab.	.014	.003	.004	.001	.002	.007	.027				
	Inc.	.000	.005	.000	.000	.003	.006	.011				
Line	Dec.	.027	.034	.024	.035	.040	.040	.026	.287	.286	.03	1.00
	Stab.	.050	.023	.038	.023	.023	.015	.000				
	Inc.	.007	.000	-.033	.000	.023	.017	.018				

*Degrees of freedom are 14 and 228.

Summary of Results

Analysis of data for research Question 1 found that the percent of local source revenut to state source revenue had changed significantly over the time period being studied. The general pattern indicated a decrease from 1969-1970 to 1972-1973 followed by a leveling off and slight increase during the last year, 1975-1976. The only differential was found for districts categorized by high and low expenditure levels. The high expenditure districts experienced a later decrease and more rapid decrease from 1971-1972 to 1972-1973 whereas the low expenditure districts exhibited a rather constant decrease for 1960-1970 to 1972-1973.

Research Question 2 examined the extend to which equalization of expenditures for ADM (adjusted for CPI) has occurred over the seven-year period being studied. The standard deviation of expenditures across districts for each year was accepted as an indicator of equalization. The analysis found no evidence to indicate that significant changes in the standard deviation (equalization) had occurred. Differences in variation, however, were found primarily between districts classified as high and low expenditure.

Research Question 3 examined the nature of the relationship between expenditures between ADM (adjusted for CPI) and five measures of service capability across the seven-year study. Although there were differential relationships for the different service capabilities, no evidience was found to indicate that this relationship has changed across the seven-year period. The only differential was found for small versus districts on the total service capability measure, regular instruction, and line administration capabilities. The relationship was weaker for large districts than small districts, but the level remained constant across the seven-year study period.

Conclusions

Based on the data and procedures employed in the present field study, the following conclusions were drawn:

1) That there has been a real shift in support of Minnesota public elementary and secondary education for General and Transportation Funds (combined) from local to state sources of revenue.

2) That there has not been a significant equalization of expenditures per pupil unit in ADM from General and Transportation Funds (combined) during the period studied.

3) That equal access to educational opportunity in terms of service capability continues to be related to expenditure per pupil unit in ADM from General and Transportation Funds (combined).

4) That the monitoring system applied in this field test demonstrates sufficient sensitivity to merit further research and development.

Implications for Further Study

The most promising area for further study indicated by this preliminary field test is in the area of service capability. It is proposed that finer measures of service capability (sub-categories in the taxonomy), rather than the relatively crude aggregates of service capability used in this paper would be more sensitive to changes in other measures. In addition to examining relationships of service capability to expenditure and revenue variables, the changes in absolute levels of service capability should also be examined. For example, preliminary descriptive statistics not presented in this paper, indicate that there have been significant changes in service capability in the sample districts, when service capability is examined in particular instructional areas.